MALARIA SIMULATING ACUTE SURGICAL DISEASES OF THE ABDOMEN

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IN recent years there has been little written about the confusing picture produced by abdominal pain which sometimes is a manifestation of malaria. Most surgeons are familiar with the postoperative fevers caused by the lighting up of a chronic malarial infection which may have been dormant before operation. It is probable, however, that the problem of differentiation between acute intraperitoneal infection and malaria may be encountered more frequently than one would expect from the writings in this country during the last 15 years. The purpose of this paper is to call attention to malaria as an occasional cause of abdominal pain, and to point out that these cases sometimes occur in temperate regions. Nine cases of malaria which simulated acute abdominal disease are presented.

The modern text-books on medicine either have nothing to say about this condition or merely mention it in passing. Many of the books on tropical medicine describe the condition briefly under various headings, such as: "The appendicitis syndrome"; "The peritonitis syndrome," *etc.*

Castallani,[1] in 1930, published a classification of the atypical forms of malaria which included the following: (1) The appendicular syndrome; (2) the cholecystitis syndrome; (3) the acute pancreatitis syndrome; (4) the peritonitis syndrome; (5) postoperative fevers; (6) malaria simulating abscess of the liver, *etc.*

Gaines,[2] in 1927, listed several atypical forms of malaria and mentioned one case simulating appendicitis, that of Deaderick, in which a patient thought at first to have appendicitis was found to have malaria.

DePenning[3] reported five cases in 1928, three of which were at first thought to have acute appendicitis, and in whom recovery was rapid and complete following the finding of parasites and the administration of quinine. One of the remaining patients was treated with quinine and failed to improve, so that operation was performed 24 hours after the patient was first observed, a gangrenous appendix being removed. The fifth patient was one who had unexplained fever following operation, which was found to be due to malaria.

In 1933, Rhodes[4] discussed atypical forms of malaria, mentioning cases in which the disease simulated appendicitis and cholescystitis, and he also called attention to several cases in which malaria was found to account for the persistence of symptoms following cholecystectomy.

Taylor,[5] in 1932, published a group of 25 cases, collected over a period of five years in Colombia, Panama, and Guatemala, 16 of whom had malaria

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proven by positive smears. He points out that this relatively small number of patients was seen in regions where the malaria morbidity is quite high, and reasons that the problem of differential diagnosis between abdominal malaria and acute surgical conditions occurs rarely. Such a conclusion obviously may not be justified, since many such cases may not be seen and since there is no means of comparison with the total number of cases of malaria observed. In his observations, Taylor lays great stress upon the absence of involuntary abdominal rigidity as a means of distinction between acute abdominal malaria and acute surgical lesions. He also points out that 85 per cent of the total number of cases gave positive tests for occult blood in the vomitus or gastric contents, and states that this finding is of great value in establishing the diagnosis of abdominal malaria.

Ninety-three per cent of the patients in the series reported by Taylor were infected with aestivo-autumnal malaria, and in most of the previous reports of cases similar to these *Plasmodium falciparum* has been the causative organism.

In a recent article by Ochsner and Murray,[6] malaria is mentioned as an occasional cause of abdominal pain and vomiting, and the following statements are made: "In our experience, acute abdominal manifestations occur most frequently in cases of malaria which have been incompletely treated. Of diagnostic importance are the relative leukopenia, absence of abdominal rigidity, and higher temperature than is usually seen in acute abdominal conditions."

No attempt is made here to review the literature on this subject. There are fairly frequent references to atypical forms of malaria in the European literature, particularly in Italy and France. It is doubtful, however, if in the United States malaria is usually considered in the differential diagnosis of the surgical diseases of the abdomen. The number of cases reported here indicates that this condition may occur fairly frequently in the Southern States.

In this group of nine cases, eight of the patients were selected from a total of 266 cases of malaria admitted to the Vanderbilt University Hospital during the last 13 years. The remaining patient was seen recently in another hospital. All of the patients were white; six were males, and four were females. The youngest patient was 15 years old, all the others being adults. All of the patients lived in rural sections except one, a student nurse at the Vanderbilt Hospital.

CASE REPORTS

Case 1.—L. C., white, male, age 46, was admitted to the Surgical Service at Vanderbilt University Hospital August 31, 1932. For six weeks he had had headache, general malaise and had been troubled with epigastric discomfort and eructation which were aggravated by the taking of fatty foods and which were occasionally accompanied by slight fever. Five days before admission he had a chill, followed by a severe headache. Three days before admission he was seized with sudden severe pain in the right upper abdomen, followed quickly by nausea and repeated vomiting. The pain remained localized and continued until admission. There was no jaundice, diarrhea, or change in the char-

acter of the stools. The past history revealed that a year and a half before admission, he had several chills, for which he was given quinine.

Physical Examination.—Temperature 104.8° F., pulse 128, respirations 28. The patient was well developed and well nourished, looked quite sick and was compaining bitterly of abdominal pain. The chest was clear. The abdomen was moderately distended, symmetrical, moved poorly with respiration. There was moderate tenderness and muscle spasm in the right upper quadrant. The liver edge was palpable slightly below the costal margin, and was smooth and slightly tender. The spleen was not palpable and no masses or other viscera were felt. The rectal examination was negative. There was no jaundice.

Red blood count 4,100,000, hemoglobin 12 Gm., white blood count 5,300. The urine contained three to four W.B.C. and an occasional R.B.C. per high power field in a centrifuged specimen.

The diagnosis on admission was acute cholecystitis, and possibly empyema of the gallbladder. Malaria was not suspected at this time, in spite of the leukopenia, and the routine blood smear was not examined until about four hours after admission. This revealed numerous ring forms of *P. vivax*. Quinine, 0.6 Gm. t.i.d., was started immediately and the symptoms disappeared quickly. The temperature rose to 103.2° F. on the day following admission but he had no chill. The tenderness over the gallbladder region subsided rather slowly, persisting to a slight degree for six days. His subsequent course was uneventful and cholecystograms were made before he was discharged from the hospital, the dye being administered intravenously. These showed concentration of the dye in the gallbladder and no stones were seen. The patient left the hospital 11 days after admission.

He returned to the Out-Patient Department four and one-half years later complaining of indigestion, frequency of urination, nocturia and dysuria. Two blood smears showed no parasites and gastro-intestinal roentgenologic examination was negative. He was found to have a stricture of the urethra and with dilatations his symptoms were relieved.

In this case the history of chills in the past and the leukopenia at the time of admission were the only things which might have suggested malaria before the parasites were found.

Case 2.—P. W., white, male, age 28, was admitted to the Surgical Service September 17, 1932, with a history of onset of abdominal pain three weeks previously. The pain was generalized, cramping in character and was associated with nausea and vomiting. Four days after onset he was seen by his doctor, who found the abdomen to be slightly tender, and markedly distended throughout. His diagnosis at that time was generalized peritonitis, possibly resulting from a perforation of the bowel. The patient refused hospitalization, and was kept in bed and given large doses of morphine at frequent intervals. The abdominal distention became progressively more marked and pain and occasional vomiting continued. He had an irregular fever which ranged from 101° to 105° F., but he had no chills. The past history was not remarkable. He had typhoid fever eight years previously; had never had malaria.

Physical Examination.—Temperature 98° F., pulse 100, respirations 18. The patient was well developed and well nourished, looked moderately ill. The skin was warm and dry. The chest was clear. The abdomen was distended and there was moderate diffuse tenderness, with a "doughy" sense of resistance to palpation, over the entire abdomen. There were no masses and the liver and spleen were not palpable. Rectal examination was negative, and the remainder of the general physical examination was not remarkable.

Red blood count 4,200,000, hemoglobin 12 Gm., and white blood count 7,000. The urine was clear; N.P.N. was 24 mg.; and the blood smear was negative for parasites.

Twelve hours after admission, the temperature rose to 102.6° F., then fell to normal

and remained there for two days. The impression during this time was uncertain, but the process was thought to be either tuberculous peritonitis or a subsiding, diffuse, acute peritonitis. On the third day, the white blood count was 4,650, and the temperature rose to 100.2° F. Blood smears and thick drop at this time revealed many crescents of *P. falciparum*. The patient was transferred to the Medical Service, and he was immediately started on atebrin, 0.1 Gm. t.i.d. The symptoms and signs almost immediately disappeared and he was discharged from the hospital nine days after admission, in good condition.

In this case malaria was not suspected until the third day of admission when there was a leukopenia coincident with a rise in temperature. There was nothing in the history or physical examination which suggested malaria as the cause of the symptoms, and the correct diagnosis was made after observation of the patient's course in the hospital.

Case 3.—J. T., white, female, age 22, entered Vanderbilt Hospital March 17, 1929, on the Medical Service. Five hours before admission she suddenly began to have severe pain in the epigastrium and in the region of the umbilicus, cramping in character, which was quickly followed by nausea and repeated vomiting. These symptoms persisted until admission. Three days before this she had a similar, less severe attack which lasted about eight hours. There had been no chills. The past history was unimportant.

Physical Examination.—Temperature 98.6° F., pulse 84, respirations 20. The patient looked quite sick, was in marked pain, and vomited during the examination. The chest was clear. The abdomen was scaphoid, moved fairly well with respiration and was symmetrical. There was no visible peristalsis and audible peristalsis was normally present. There was moderate tenderness in the epigastrium and about the umbilicus, but there was no muscle spasm and no masses could be felt. The liver and spleen were not palpable. Pelvic and rectal examinations were negative and the remainder of the general physical examination revealed no abnormalities.

Red blood count 4,500,000, hemoglobin 12 Gm., white count 10,000. Routine blood smears were normal and showed no parasites. The urine was clear.

The diagnosis at this time was not clear, though partial intestinal obstruction and ureteral calculus were mentioned as possibilities. Because her symptoms continued, she was transferred to the Surgical Service a few hours after admission. During the next two days her symptoms varied in intensity, occurring in attacks which came on every few hours. The temperature remained normal, and on the third day, moderate tenderness in the region of the left kidney was noted. The kidney was not palpable and the urine was clear. She was cystoscoped, both ureters were catheterized and pyelogram of the left kidney was made, with negative results. Shortly after the cystoscopy she had a chill and her temperature rose to 104° F. Routine blood smear obtained at this time showed many forms of *P. vivax*. She was given quinine, 0.6 Gm., at once, and this was continued t.i.d. The temperature remained normal thereafter and all symptoms and physical signs rapidly disappeared. She left the hospital on March 30, 13 days after admission, in good condition.

In this case, the diagnosis was particularly difficult, and the parasites were found in a smear which was obtained as a part of the routine examination when the patient unexpectedly had a chill.

Case 4.—M. M., white, female, age 15, was admitted to the Surgical Service of Vanderbilt Hospital March 12, 1930. For nine months she had had intermittent attacks of pain and soreness in the right lower quadrant and the right lumbar region. At the onset she had several chills at irregular intervals, but these stopped after a few weeks. About three months after the onset, she had rather marked dysuria and frequency of urination during an attack of pain, and these symptoms occasionally recurred with subsequent attacks. On one occasion she had hematuria.

The last attack began five days before admission with pain in the right lower abdomen, which continued without relief. She was nauseated and 48 hours before admission she vomited. There were no chills but she thought she had had some fever. The past history was of no importance.

Physical Examination.—Temperature 99.8° F., pulse 94, respirations 22. The patient was well developed and well nourished, looked moderately ill. The chest was clear. The abdomen was scaphoid, symmetrical, and moved fairly well with respiration. There was moderate, well localized tenderness in the right lower quadrant and slight tenderness in the left lower quadrant. There was no muscle spasm and no masses were felt. The liver and spleen were not palpable. Pelvic examination revealed tenderness in both adnexal regions but no masses could be felt. There was no vaginal discharge. The remainder of the physical examination was essentially negative.

Red blood count 3,000,000, hemoglobin 9.2 Gm., white count 4,400. The urine contained only occasional white blood cells.

On admission it was thought that she had acute appendicitis or acute pyelonephritis. Because of the leukopenia, the routine blood smear was examined with great care, and a few forms of *P. vivax* were found. She was immediately started on quinine, 0.6 Gm. t.i.d., and the symptoms and physical signs quickly disappeared. She was discharged from the hospital four days after admission, in good condition.

Three and one-half years later, on September 24, 1933, she returned to the hospital with abdominal pain of three days' duration, accompanied by nausea and vomiting. Parasites were again found in the blood and with the administration of quinine, she rapidly recovered.

Case 5.—J. A. J., white, male, age 34, was admitted to the Surgical Service May 19, 1935. Four days before admission he became nauseated, and shortly thereafter had a chill. He continued to feel badly and was nauseated until 14 hours before admission when he suddenly began to have severe, cramping pain in his upper abdomen. This was followed by repeated vomiting, and the pain soon became generalized through the abdomen. Shortly after the onset a fine rash appeared over the trunk. The abdominal pain continued until admission, but he had no more chills. The past history revealed no important information.

Physical Examination.—Temperature 99.4° F., pulse 96, respirations 30. The patient was well developed and well nourished, looked moderately ill and was writhing with pain in the abdomen. The chest was clear. The abdomen was scaphoid and moved well with respiration. There was moderate tenderness around the umbilicus but no muscle spasm. No masses were felt and the liver and spleen were not palpable. Rectal examination was negative and nothing else of importance was found in the examination.

Red blood count 4,700,000, hemoglobin 15 Gm., white count 5,100. No parasites were found in the blood smear. The urine was clear.

The diagnosis was not clear. Because of the character of the onset of symptoms, food poisoning was suspected. About four hours after admission the temperature rose to 103.6° F., but he did not have a chill. Blood smears and thick drop at that time revealed many ring forms of *P. vivax*. No treatment was instituted at that time, however, and on the day following admission his symptoms were much less marked and the temperature remained normal. On the third day the temperature rose to 103.6° F. and he had a chill. He was then given quinine 0.6 Gm. t.i.d., with prompt relief of all symptoms and disappearance of abdominal tenderness. He was discharged from the hospital two days later.

Malaria was thought of as a possibility here because of the leukopenia and the lack of an adequate explanation for his symptoms. A careful search of the blood smears was required before the parasites were found.

Case 6.—E. H., white, female, age 24, was admitted to the Medical Service September 9, 1932, with a history of onset of severe knife-like pain in the right lower quadrant of the abdomen four days previously. The pain radiated to the lower back and was accompanied by nausea and repeated vomiting. After the first day there was no nausea, but there was severe headache and backache, and two days before admission she had a chill. This was followed by a watery diarrhea which continued until admission, and by persistence of the pain in the right lower abdomen. She had had frequent dull headaches for two months prior to admission. There was no history of malaria in the past.

Physical Examination.—Temperature 101° F., pulse 112, respirations 22. The chest was clear. The abdomen was scaphoid, symmetrical, and moved fairly well with respiration. There was moderate diffuse tenderness in the right lower quadrant and in the right upper quadrant under the costal margin, but no rigidity. The spleen and liver were not palpable and no masses were present. Pelvic examination revealed moderate tenderness in both adnexal regions. No masses were present. The physical examination was otherwise negative.

Red blood count 4,300,000, hemoglobin 11.5 Gm., white count 8,700. Smear of the blood was negative for parasites. The urine was clear except for occasional white cells.

It was thought on admission that she had an acute enteritis.

Her temperature fell and remained normal on the second day, but on the third day she had a severe chill and the temperature rose to 106° F. The abdominal pain became very severe at this time. The white blood count was 3,400, and blood smears and thick drops were obtained which showed many ring forms of *P. vivax*.

She was given atebrin 0.1 Gm. t.i.d. Her symptoms and physical signs rapidly disappeared and the temperature subsequently remained normal. She left the hospital in good condition on September 22, 13 days after admission.

She was seen again August 12, 1938, because of a nontoxic goiter which was becoming slowly larger. She had had no further attacks of abdominal pain and no symptoms suggesting malaria.

Case 7.—M. F., white, male, age 33, was admitted to the Surgical Service August 12, 1934. Four days before admission he began to have cramping epigastric pain which was soon followed by nausea and vomiting. These symptoms persisted until the time of admission. There was high fever but no chills and there was no history of previous similar attacks. The patient had had an appendicectomy previously and had been given typhoid vaccine 10 years ago.

Physical Examination.—Temperature 104.6° F., pulse 120, respirations 24. The patient was fairly well developed and well nourished. He looked quite sick and vomited several times during the examination. The chest was clear. The abdomen was symmetrical, moderately distended, and moved very slightly with respiration. There was moderate general tenderness, with fairly marked tenderness in the epigastrium. There was some resistance to palpation throughout the abdomen, with no localized areas of muscle spasm. No masses were felt and the liver and spleen were not palpable. The physical examination was otherwise not remarkable.

Red blood count 5,000,000, hemoglobin 13.5 Gm., white count 2,000. Because of the leukopenia the routine blood smears were examined very carefully, but no parasites were found. The urine examination was negative, the Widal and several stool examinations and cultures were negative and blood culture remained sterile.

The impression at the time of admission was typhoid fever, and malaria was mentioned as a possibility.

About 24 hours after admission a macular rash, which was generalized over the body, appeared. At this time the leukocyte count was 7,200. Smears of the blood were again examined with negative results. A thick drop was also obtained, however, and this showed ring forms of *P. falciparum*. The patient was transferred to the Medical Service and was immediately started on quinine 0.6 Gm. t.i.d. His temperature fell to

normal within 24 hours, and the symptoms subsided rapidly. He was discharged from the hospital nine days after admission.

Case 8.—G. H., white, male, age 27, came to the Vanderbilt Hospital emergency room August 6, 1935, complaining of severe abdominal pain. Five days before this he began to have general malaise and headache. Three days before admission he was awakened at night with sudden, severe, knife-like pain in the right upper abdomen and the right flank, which soon became generalized and cramping in character. These symptoms continued without relief but varied in intensity. He was repeatedly nauseated but did not vomit. He had no chills but thought he had some fever. A few hours before admission he was seen by his family doctor who told him he had a ruptured appendix and advised him to go to the hospital.

The past history revealed that the patient had for several years lived in an unscreened house on a river bank. He had received typhoid vaccination three years previously and had always been in good health. The family history was of some importance in that two sisters had frequently had "chills and fever."

Physical Examination.—Temperature 101.4° F., pulse 126, respirations 32. The patient was well developed and well nourished. He looked quite sick and was writhing in pain. The chest was clear. The abdomen was scaphoid, moved almost none with respiration, and palpation revealed board-like rigidity throughout the abdomen, which was most marked, however, in the right upper quadrant. There was moderate tenderness and this was only present in the upper abdomen. The liver and spleen were not palpable and no masses were felt. Rectal examination revealed nothing remarkable and the remainder of the general physical examination was negative.

It was first thought that this patient had a diffuse peritonitis, probably due to a perforated duodenal ulcer. Because of the history, however, and because of the absence of very marked tenderness, malaria was suspected by the Surgical House Officer who saw him in the emergency room, and who had previously seen two of the patients in this group. Smears of the blood were obtained which showed ring forms of *P. vivax* in large numbers.

The patient was admitted to the hospital on the Medical Service. Red blood cell count 2,500,000, hemoglobin 6.5 Gm., white blood cells 5,800. The urine was clear. He was started at once on quinine, receiving 0.6 Gm. three times daily. His temperature rose to 104.2° F. 18 hours after admission, but he had no chill. His temperature then fell to normal, the symptoms and physical signs disappeared rapidly and the temperature remained normal. He was discharged from the hospital 10 days after admission in good condition.

Case 9.—D. S., white, female, age 64, was admitted to the St. Thomas Hospital July 15, 1938. One month before admission she was suddenly seized with severe pain in her right upper abdomen. Shortly after this she had a severe chill. During the following week she was extremely sick with abdominal pain, repeated vomiting and high fever. She was delirious during part of this time but had no more chills. At the end of a week she began to improve and two weeks after the onset she was able to be out of bed. She was then well, except for occasional moderate upper abdominal discomfort, until about 30 hours before admission, when the severe pain again struck her in the right upper abdomen. A few minutes later she had a chill and following this, she had high fever and was delirious. The pain and delirium continued until admission and were accompanied by repeated vomiting. She had no more chills.

The past history revealed that for many years she had been having attacks of milder pain in the right upper abdomen which did not radiate and which often was severe enough to require her to go to bed. Between these attacks she was sometimes troubled with indigestion, characterized by epigastric discomfort and eructation following meals. She had had no chills previous to the present illness.

Physical Examination.—Temperature 105.4° F., pulse 110, respirations 30. The patient was a fairly well preserved white woman who looked extremely sick. She was stuporous and answered questions so poorly that most of the history obtained at the time of admission was given by her son. The skin was dry and hot, the face was flushed. There was no jaundice. The chest was clear. The abdomen was symmetrical, slightly distended, and there was marked limitation of respiratory movements on the right side. There was marked tenderness and muscle spasm in the right upper quadrant, and moderate tenderness in the left flank, near the costal margin. The liver and spleen were not palpable at this time but examination was difficult because of the marked tenderness. No masses were felt. The pelvic and rectal examinations were negative and nothing remarkable was found in the remainder of the physical examination.

Red blood count 4,500,000, hemoglobin 13.2 Gm., white count 6,100. The urine was clear.

At this time it was thought that the patient had acute cholecystitis. The presence of malaria was not suspected. Routine blood smear for the differential count, however, showed what was thought to be a few parasites. A thick drop and subsequent smears showed many parasites of tertian malaria.

She was immediately given quinine dihydrochloride 0.6 Gm., intramuscularly, and atebrin 0.1 Gm. by mouth. The temperature dropped to normal within six hours and at the end of this time she was more alert, the pain was less marked and the tenderness and muscle spasm were considerably less pronounced. The spleen could then be felt to extend about 4 cm. below the costal margin. It was moderately tender. The liver edge could also be palpated but no masses could be felt below it. She received three subsequent doses of quinine dihydrochloride 0.6 Gm. intramuscularly at four hour intervals, and on the second day she was started on atebrin 0.1 Gm. t.i.d. The temperature remained normal and by the fourth day all abdominal tenderness had disappeared and the spleen was smaller, though still easily palpable. She was discharged from the hospital five days after admission in good condition.

SUMMARY.—Six of the patients in this group were admitted as emergencies to the Surgical Service, and the remaining three were admitted to the Medical Service. One of the patients admitted to the Medical was transferred to the Surgical Service soon after admission, and all the patients in the series were carefully observed by the surgical staff until the diagnosis was definitely established, and the abdominal symptoms had subsided.

An analysis of this series of cases reveals the following facts: The diagnosis of malaria was suspected and finally established because of: The presence of leukopenia on admission in two patients. A rise in temperature accompanied by a leukopenia, at some time after admission, in three patients. The occurrence of an unexplained chill in two patients. In two patients, the parasites were found in the routine blood smear.

Sudden onset of severe abdominal pain occurred in six patients. In the remaining three the pain was at first relatively mild, and gradually increased in severity. Nausea accompanied the pain in all cases, and vomiting occurred in eight. Only three patients had prodromal symptoms such as headache and general malaise, and in only three patients was there a history of previous attacks of abdominal pain similar to the present illness. The past history was of significance in suggesting malaria as a cause of the symptoms in two patients, and chills occurred during the present illness in only three cases.

Leukopenia was an important finding in most of the cases in this series,

being present on admission in six of the nine patients. In two other cases the white blood count fell below normal after admission, coincident on both occasions with a rise in temperature, and in each case parasites were found at the time of the rise in temperature. The white blood count was elevated in one patient on admission. Only three patients had very high fever at the time of admission. Two others had normal temperatures and in the remaining four cases there was a slight or moderate temperature elevation.

The spleen was felt in only one case, and this patient had such marked abdominal tenderness and muscle spasm that neither the liver nor spleen was palpable until several hours after the parasites had been found and quinine administered. Among the remaining eight patients, the liver could be felt in only one.

In three of the patients in this series, there was definite involuntary rigidity of the abdominal wall at the time of admission to the hospital.

The two patients who gave past histories of malaria had received, as well as could be determined, inadequate treatment. The other eight patients, however, had never had symptoms of malaria and had never received antimalarial treatment.

The importance of painstaking, unhurried examinations of the blood in cases similar to those reported here cannot be overemphasized. Parasites are often found by the thick-drop method of examination when they are not numerous enough to be seen in smears. In one of this group of patients, parasites were never found in the smears but were easily seen in a thick drop, and in four others thick drops were examined to confirm the findings in the smears. Repeated examinations of the blood were performed in five cases before parasites were seen.

In this group of nine patients, *P. vivax* were found in the blood of seven and *P. falciparum* in the remaining two patients.

CONCLUSIONS

The usual criteria for differentiation of malaria from the common, acute surgical diseases of the abdomen are strikingly inadequate in most of the cases in this series. High fever was not present in most of the patients and abdominal rigidity, which is usually said to be absent in most patients, was present in three of the nine cases reviewed here. The abdominal signs varied greatly, and the usual physical evidences of malaria such as enlargement of the spleen and liver were rarely present.

On the other hand, leukopenia was present in eight of these patients either at the time they were first seen or soon afterward, and this finding, therefore, may be of considerable aid in suggesting the presence of malaria. The examination of a blood smear and thick drop as quickly as possible following a chill or an unexpected sudden elevation of temperature is an important procedure in examination which led to the establishment of the correct diagnosis in five of these patients.

The finding of malaria in the blood of patients who present findings char-

acteristic of intraperitoneal disease obviously does not exclude the possibility that such a disease may also be present. This is well illustrated in another patient, not included in this series, in whom parasites of tertian malaria were easily found, but who had the classic physical evidences of a spreading peritonitis. Operation was delayed for several hours during which time vigorous antimalarial therapy was administered. Because the symptoms and physical signs were unchanged, celiotomy was then performed, and a perforated duodenal ulcer and localized peritonitis were found.

That abdominal manifestations of malaria may occur fairly frequently is indicated by the fact that eight of the cases reported here occurred among a total of only 266 cases of malaria admitted to the Vanderbilt University Hospital. This total number includes all patients in whom a diagnosis of malaria was made, regardless of the conditions for which the patients were admitted to the hospital.

It is surprising that seven of the patients in this series were found to have tertian malaria, since the predominant organism has been *P. falciparum* in previous reports of cases similar to these. The predominant organism in the temperate regions of North America is *P. vivax*, and these cases serve to call attention to malaria as a problem in differential diagnosis among the acute surgical diseases of the abdomen in the Southern United States.

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